Construction and Demolishment Waste management

Reducing, Recycling Reusing & Recovery

By

Prof.(Dr.) Madhura Yadav

Architect Planner

Dean, Faculty of Design

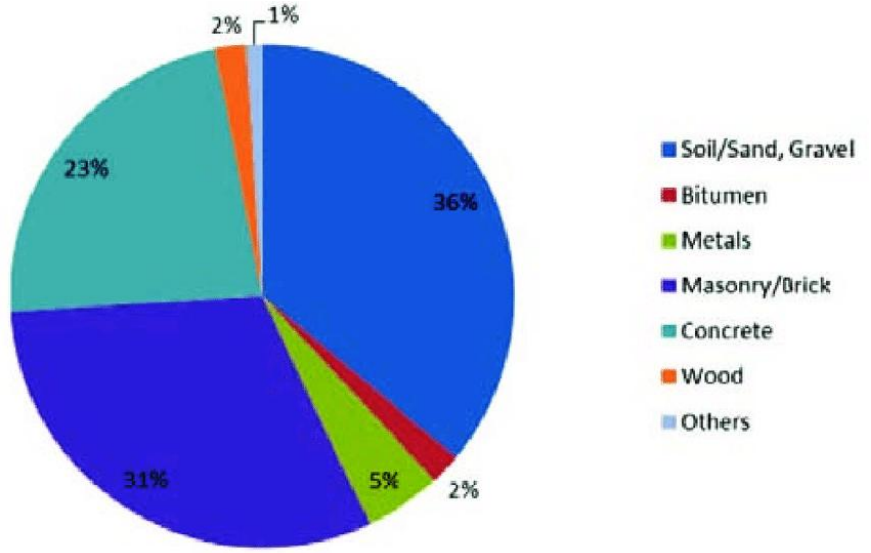
Manipal university Jaipur

Structure of the presentation

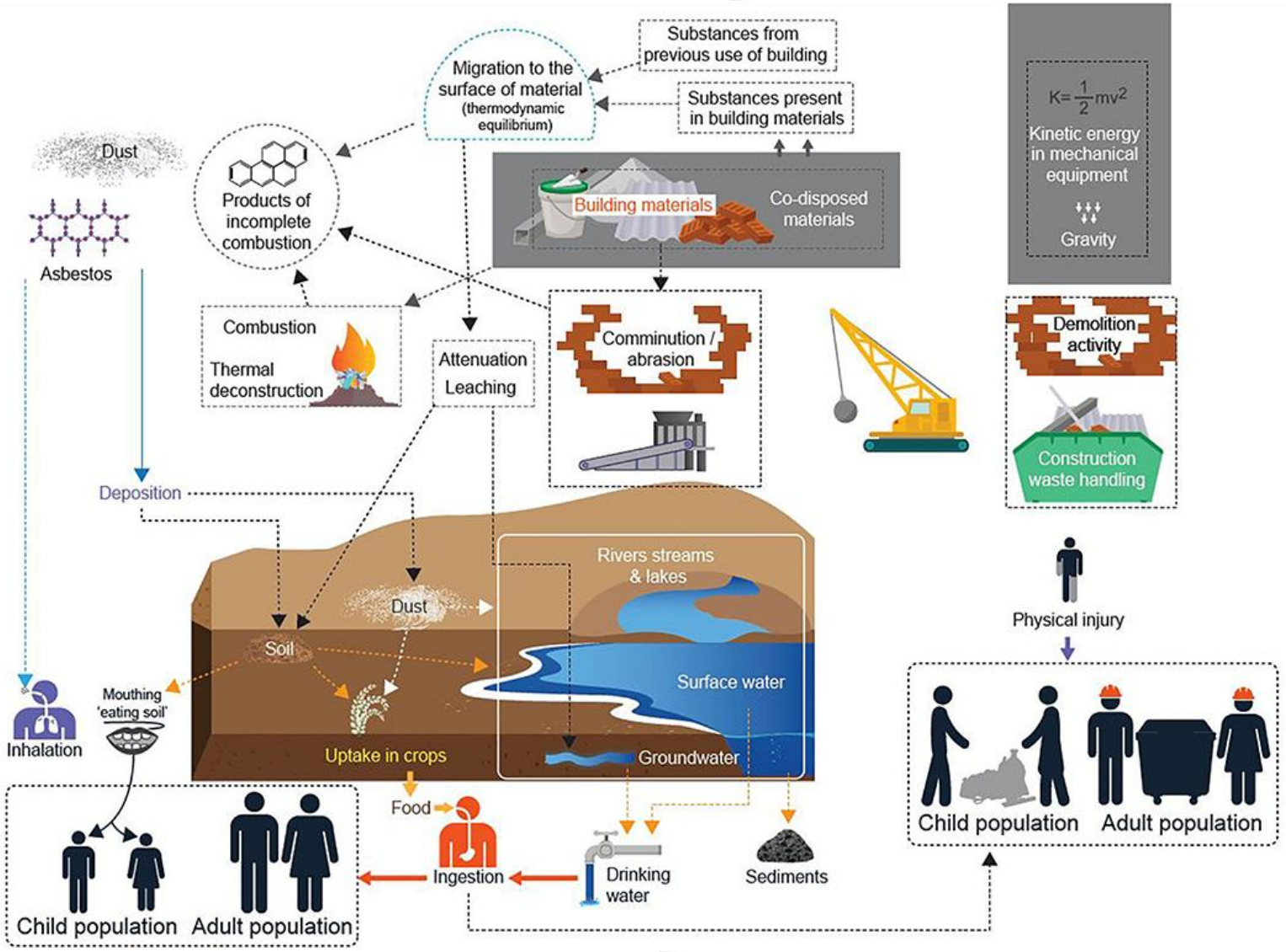
- What is C&D waste & classification
- Impact of C&D Waste
- C& D waste management: Indian Scenario
- Global Scenario
- Comparison of India with other contries
- Challenges
- The way forward
- Conclusion

Introduction to C&D waste management

- Waste material that is produced in the process of construction, renovation, natural disaster or demolition of structures. Structures include buildings of all types (both residential and non-residential) as well as roads and bridges. Components of C&D debris typically include concrete, bitumen, masonry/brick wood, metals, soil, sand/gravel



Sourtce: https://everydayrecycler.com/zero-waste-hierarchy



Source:https://www.frontiersin.org/files/Articles/924926/frsus-03-924926-

- waste from natural calamity
- waste from excavation
- waste from demolition of old buildings,
- waste from construction site,
- waste from housing decorations.

Impact of C&D waste

Environmental contamination - Soil
https://www.skyfilabs.com/project-ideas/construction-demolition-waste

Air and dust pollution
https://gosmartbricks.com/5-ways-to-reduce-air-pollution-at-construction-site/

Non-recycled Debris (Resource drain)
https://timesofindia.indiatimes.com/city/delhi/watch-your-waste-debris-weighs-down-city/articleshow/67907886.cms

Untreated waste in an urban area (Poor urban living)
https://www.hindustantimes.com/cities/gurugram-news/transfer-of-c-d-waste-plant-operations-under-scanner-101627842204526.html

Land occupation –Construction, demolition,
Dumping.
https://www.tribuneindia.com/news/chandigarh/few-takers-for-cd-waste-lifting-facility-365671

Water Pollution
https://cdn.cseindia.org/userfiles/Avikal%20Somvanshi.pdf

C& D Waste Management : Indian Scenario

- CW generated in India is **150 MT** - for **35%–40%** of the global C & D waste annually.
- CSE (Centre for Science and Environment)estimated that, India recycles just **1%** of its C & D waste that is being generated
- Furthermore, it is estimated that, 53 major cities are targeted to setup recycling plants of which 13 are established
- India's first C & D waste recycling plant is started in 2009 at Burrari with a recycling capacity of 2000 Tonnes per day (TPD). Few other operating recycling plants are located at Ranikhera, Shastripark, Gujarat, Andhra Pradesh, Telangana and Madhya Pradesh
- Several other recycling plants are proposed at Ghumanhera, Libaspur, Kapashera, Bakkarwala., Panaji, Coimbatore, Kannur, Mallasandra, Anjanapura, Wagholi, Fathullaguda and Kapuluppada.

Schemes and regulations

Laws and policies framed in India related to pollution:

- **Swachh bharat mission (SBM):** by the Ministry of Housing & Urban Affairs (MoHUA) in 2014. ***Target of the mission:*** Planning of "deconstruction" activity, establishment of bye-laws are included in the mission. Moreover, based on its importance the SBM doubled the awardable points to 100
- **Guidelines on environmental management of construction & demolition (C & D) wastes:** The central pollution and control board (CPCB) issued new rules that were published on 29th March, 2016 by the Ministry of Environment, Forest and Climate Change (MoEF & CC). Construction projects producing more than 20 tons of C & D waste in a day or 300 tons in a month need to draft and submit the site waste-management plan (SWMP) to the local authorities
- **Guidelines for Sustainable Habitats (GSH):** The central public works department's (CPWD) 2014 released a report – "Guidelines on re-use of recycled C & D waste". The guidelines include measures and precautions for recycling of CDW, as well as emphasize the need for deconstruction plans. Guidance is provided for recovering valuable products which can be reused without further processing.

Schemes and regulations….

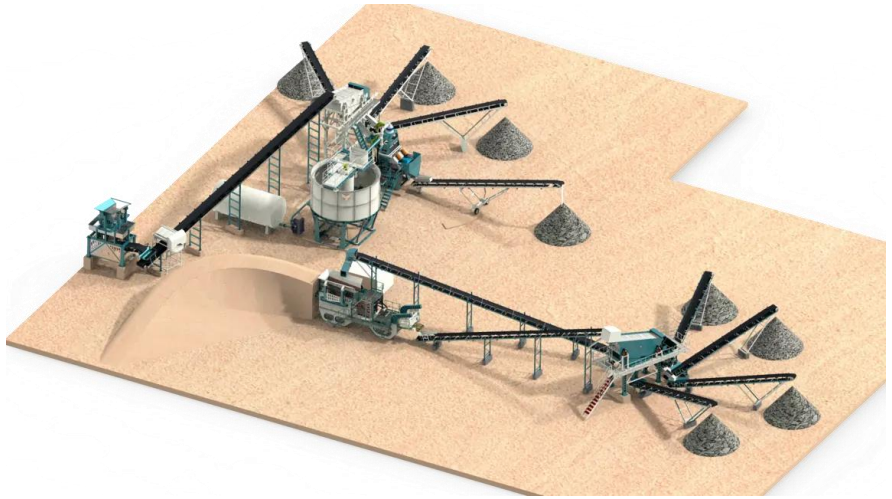
- **Ministry of Urban Development (MoUD):** The urban development ministry, issued a circular on June 28,2012 to establish recycling centres in cities and towns with population greater than 1 million and established governance rules. The MoUD plans to establish temporary storage points in every panchayat raj systems/municipalities.
- **Bureau of Indian Standards (BIS):** BIS is responsible for issuing specifications and codes for the recycled products. The updated IS:383(2016) recommends a replacement, of 25% in PCC, 20% in RCC and 100% in lean concrete, with recycled aggregate.
- **Building Materials &Technology Promotion Council (BMTPC) & Ministry of Housing and Urban Affairs (MoHUA) :** BMTPC issued regulations on C & D waste utilization in government projects. Similarly, MoHUA passed an order to utilize C & D waste products if they are available within 100 kilometres radius of the construction site.
- **National Building Code (NBC)-Approach to Sustainability (2005):** Part 11 of NBC recommended the various applications of recycled concrete aggregate (RCA). In addition, NBC reported that, 30% of RCA can be used for building projects and up to 50% for members subjected to pure compression. NBC mandates usage of recycled materials in Government construction projects. Few other guidelines, replacement recommendation are presented under appendix.

Case Studies in India

Case 1: Delhi has developed a centralized facility which handles over 2000 tonnes of C&D wastes all over the city. Recycle and reuse the wastes in infrastructure projects. Below is the recycling plant in Delhi.

https://constrofacilitator.com/an-overview-of-cd-waste-recycling-plants-and-their-demand/

Case 2: Ahmedabad uses C&D wastes to recycle and reuse them into roads which is a long-term goal for a durable project initiative. Below is the illustration of the recycling plant in Ahmedabad.



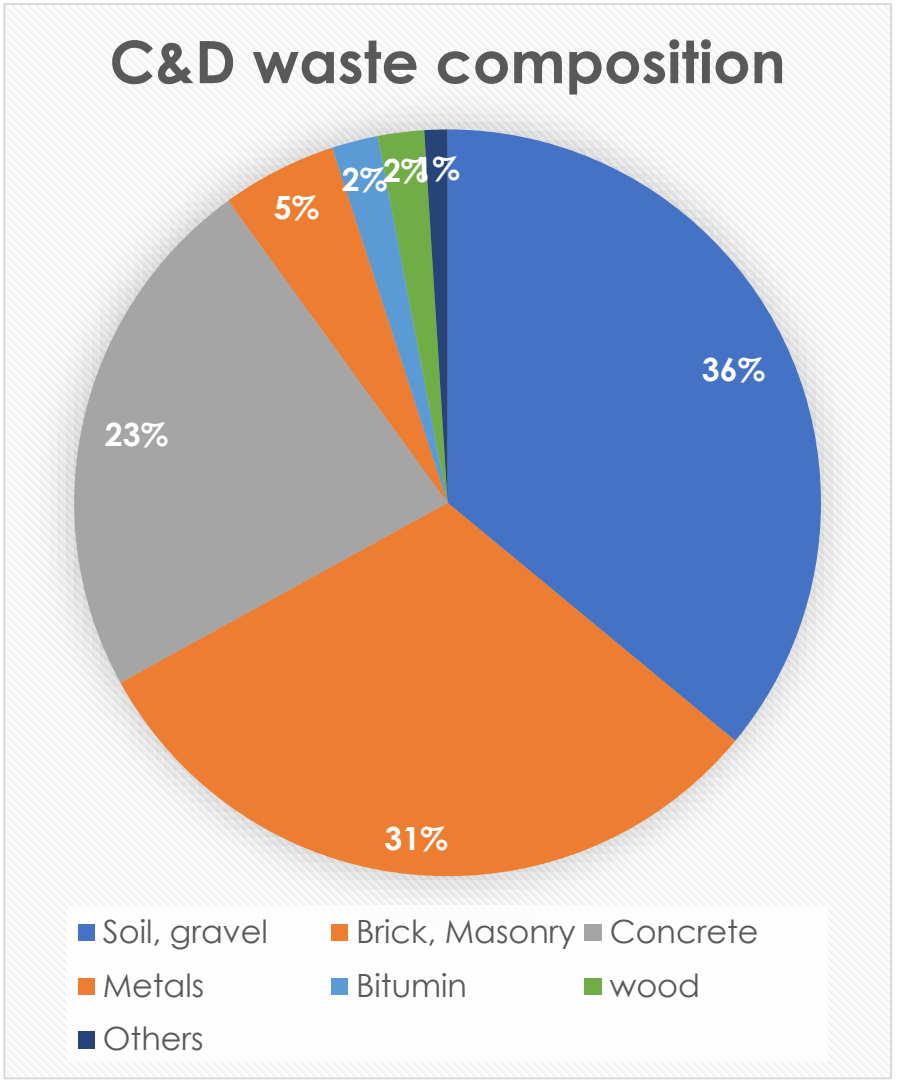
https://www.picsinternational.com/c-d-waste-recycling-technology.php

Case 3: Kochi adopted advanced machinery to automate the waste management and sorting process. Making it into a proper construction material for buildings.

https://www.deccanchronicle.com/nation/in-other-news/140617/kochi-corporation-to-cancel-new-waste-removal-deal.html

Global initiatives

- European Union: 70% of construction waste to be recycled or recovered by 2020.
- USA: State regulations to utilize resources better. USA consumes the most construction resource out of any country in the world. They aim to achieve zero waste by 2030.
- Asia-Pacific: Technology advancements on reuse and recycling wastes to resource limitations, cost, population and demand.
- Africa: Resource and waste utilization due to limited resources. A different set of norms and standards.



A case study from Denmark

Denmark has one of the highest construction waste recycling rates in the world.

- The Danish government has set stringent regulations for waste sorting at the source, which facilitates more efficient recycling.
- The country also boasts advanced waste treatment technologies and infrastructure, supporting the recycling effort

Waste to energy & recycled products plant, by BIG in Copenhagen, Denmark

Source : https://www.thestar.com.my/lifestyle/living/2021/12/04/a-waste-to-energy-plant-with-ski-slope-in-denmark-named-world-building-of-the-year-2021

A case study from Germany

- Germany has always been at the forefront when it comes to recycling. The country's Closed Substance Cycle and Waste Management Act ensures that waste is avoided, reduced, and recycled.
- Construction waste is sorted into recyclable materials like metals, wood, and concrete. These materials are then either reused or converted into new products.
- As a result, Germany has one of the highest C&D waste recycling rates

Waste recycle & energy plant and research centre in Augsburg, Germany

Source : https://www.wtert.net/bestpractice/265/AVA-%28Waste-Treatment-Augsburg%29-Germany-Energetic-and-Material-Recycling-Under-One-Roof-Leads-to-Considerable-Synergies.html

A case study from USA

Successful strategies in USA:

- Availability of satisfactory commercial opportunities for C & D waste products (Akhtar and Sarmah, 2018).
- Incentive & reward schemes for zero C & D waste emissions along with higher investments for C & D waste recycling, management, treatment i.e. 7 billion USD (Akhtar and Sarmah, 2018).
- Design for deconstruction (demolition as well as product design for disassembly) (US Environmental Protection Agency, 2018).
- Increased rate of C & D waste recycling i.e. up to 70% (Calvo et al., 2014).
- Availability of information on C & D WM and corresponding activities through sustainable material management (SMM) (US Environmental Protection Agency, 2016).

Recycling plant in USA

Source : https://www.machinexrecycling.com/news/a-new-cd-recovery-facility-for-usa-waste-and-recycling/

Trinidad circle, sustainable home in, Los Angeles, USA

Source : https://www.wallpaper.com/architecture/trinidad-circle-framework-palm-springs-usa?utm_source=Newswav&utm_medium=Website

A case study from UK

The **UK government** has put regulations in place to encourage recycling in the construction industry.

- The Site Waste Management Plans (SWMP) initially made it mandatory for construction projects costing over £300,000 to have a waste management plan, although this regulation has since been revoked, the industry has recognized its importance.
- The target is to recycle or recover at least 70% of construction and demolition waste by 2020, and many construction firms already surpass this.

Recycling metal waste from construction site in UK

Source : https://wastersblog.com/98112/construction-waste-recycling-methods/

House made using recycled materials in Brighton, UK

Source : https://probuildermag.co.uk/features/waste-not-want-not

A case study from France

- France has been proactively working towards reducing landfill waste by implementing strict regulations for waste disposal and promoting recycling.
- The country aims for a significant reduction in the landfilling of non-hazardous waste, with a target of a 50% reduction by 2025.
- Many French construction companies have committed to green building practices, which includes recycling most of their construction waste.

Green roof norm on all commercial buildings, renovations using recycled materials

Source : https://cleantechnica.com/2022/05/05/new-law-in-france-green-roofs-on-new-commercial-buildings/

Successful strategies in China

Availability of comprehensive policy structure and circular economy .

- Imposition of penalties on the discharge of C & D waste i.e. 300–350 RMB per ton
- Incorporation of incentive schemes for successful management i.e. 20–30 RMB per ton).
- Extended research on C & D waste
- Usage of latest techniques such as BIM, GPS, GIS and Big Data, Integrated Project Delivery (IPD), Virtual Prototyping, and CAD for improving performance and minimization of CW
- Appointment of structured supervisory teams for proper discharge of C & D waste and expenditure of collected penalty for daily operations and subsidies in the particular locality

Successful strategies in Australia

- Development of an updated legislative instruments for resource recovery, waste avoidance, reduction, reuse, recycling and development of codes at each state and territory
- Enforcement of landfill disposal levies i.e. higher landfill taxes in comparison to cost of recycling make C & D waste recycling an essential option
- Establishment of C & D waste management and landfill diversion targets in all the jurisdictions i.e. (70%–90%)
- Establishment of waste data management system which includes "Data and Reporting" and "Market Development and Research", for creation and maintenance of markets for recycled materials globally

Projects made from recycled waste

Zig-Zag house, USA. Made from recycled Polycarbonate, metals and glass

Manav Sadhna, Ahmedabad, India. Made from recycled fly ash blocks, metals, plastics and glass.

Mixed Hues, Mumbai, India. Includes old damaged recycled doors and windows on the façade.

SOS Children's village lavezzorio community centre, Chicago, USA. Uses recycled concrete aggregate and wastes from different construction sites

Redondo beach house, USA. Uses recycled steel containers and fabrics for exterior and interiors, respectively.

Recycled materials cottage, Chile Uses recycled steel. Wood, concrete from various C&D sites in the area.

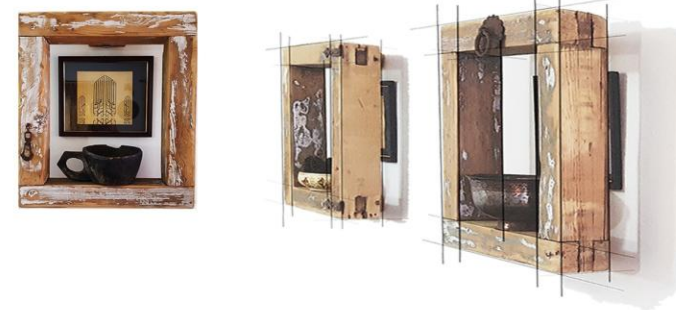
Source : https://www.re-thinkingthefuture.com/designing-for-typologies/a4102-15-architectural-projects-made-out-of-recycled-materials/

RETHINKING VERNACULAR ARCHITECTURAL VOCABULARY

Adapting the design of "varusi" (Traditional Kashmiri removable partition screens) to a wardrobe

INCORPORATING TRADITIONAL KASHMIRI CRAFTS OF "*PAPIER MACHE*" AND "*PINJRAKARI*" INTO CONTEMPORARY ARCHITECTURAL PRACTICES

Re-purposing of antique window into a coffee table



UP-CYCLING SALVAGED WOOD TO FRAME THE PAST SPLENDOUR

Reconstruction of old properties is followed by a lack in the sense of belongingness. With required makeover, old wood left over's and discards have been made into a variety of aesthetic objects of decor and utility that fade away the alienation

A case study from Japan

Source :
https://www.dezeen.com/2021/11/09/kamikatsu-zero-waste-center-hiroshi-nakamura-architecture/

- Japan has advanced technologies for recycling construction waste, especially concrete, which is often repurposed into aggregates for new construction projects.
- The image above is an example of a waste recycling centre, Kamikatsu Zero Waste centre in village Kamikatsu, Japan, is made out of waste materials using recycled glass, wood, tiles, brick and fabric.

Comparative performance of India with other countries

- **C&D waste management plans are missing**
- **Economic facilities**
- **Taxes and penalties**
- **Onsite waste prevention, collection and documentation management**
- **Materials recovery, re-use and quality standards**

All other countries recognize the environmental and economic benefits of recycling construction and demolition waste. Through a combination of regulations, advanced technologies, and industry initiatives, they have achieved substantial recycling rates in the construction sector.

Challenges in India

- Lack of regulations
- Inadequate infrastructure
- Contamination
- Technological limitations
- Economy
- Public awareness
- Environmental hazards
- Rapid Urbanization
- Limited space for disposing and recycling

Way forward for India

- **Social awareness** towards sustainable environment is crucial Through rules, regulations & control instruments (strict penalties) there will be perceptible changes in attitudes of workforce associated with C & D WM in India.
- **R&D** for resource efficiency.
- **Efficient collaborations** for progression of sustainable environment
- **Inclusion** of state govt and urban local bodies (ULB)for proper disposal of C & D waste
- **Standardization** of CWM practices along with an administrative head specifically for C & D waste

Way forward for India…..

- **Adapting process flow monitoring** of waste generation, collection, transport at onsite
- **Establishing check-up points** for illegal transportation of C & D waste
- **Providing barcode or QR coding system** and enrouting GIS tracking system for C & D waste to document hauling routes and final destinations to prevent illegal disposal
- **Penalizing contractors** without site waste management plans can improve CWM implementation.
- **Providing adequate knowledge** on the costs associated for CWM implementation
- **Creating awareness** among regarding negative effects such as loss of valuable recyclable material due to illegal disposal of the C & D waste.

Digitalization of C & D Waste Managment

Necessary for easy accessibility of the data. Therefore, providing training on usage of latest techniques such as

- Integrated Project Delivery (IPD),
- Virtual Prototyping, and CAD are successful global strategies for improving C & D WM.
- Implementing CWM, can preserve raw materials and ensure numerous environmental and social benefits.
- Enhancing the attitudes associated for implementing WM by

(i) Creating market of recycled products

(ii) addition of financial drivers

(iii) marketing recycled products at a lower price in comparison with the conventional products can improve the C & D WM status in India.

Implication of the research on academia, industry and policy developers

- Establishment of contractual clauses which are requisites for implementing CWM,
- Framing of legislations which includes deconstruction plan at planning phase,
- Amendments in existing green building rating systems such as GRIHA, LEED,IGBC BREEAM etc.
- Recruiting and training workforce
- Setting up of recycling target for every project
- Framing of GST tax waiver policies
- Creation of societal awareness and
- Improving employee motivation for implementing CWM.
- Improving individual behaviour towards material efficiency and sustainability.

Research and solutions

WASTE TO ROADWAYS

WASTE TO BUILDING BLOCKS

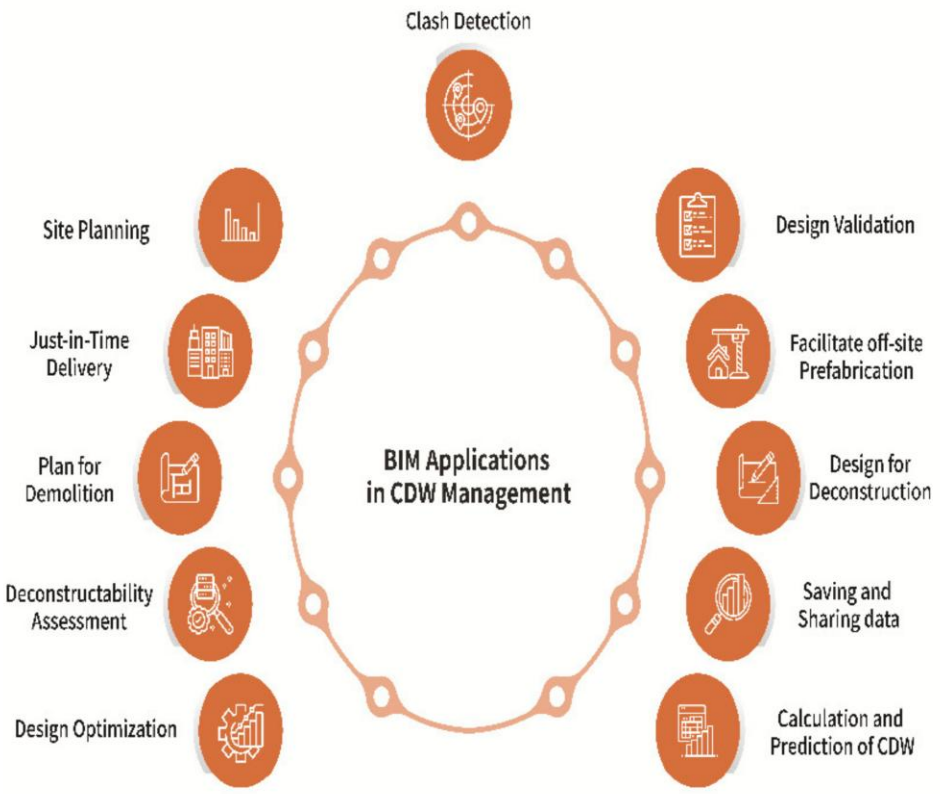
WASTE TO INSULATION

BIO-COMPOSITE MATERIALS (AS RESEARCH)

LAND RECLAMATION BY TREATING CONSTRUCTION/DEMOLITION ON SITE.

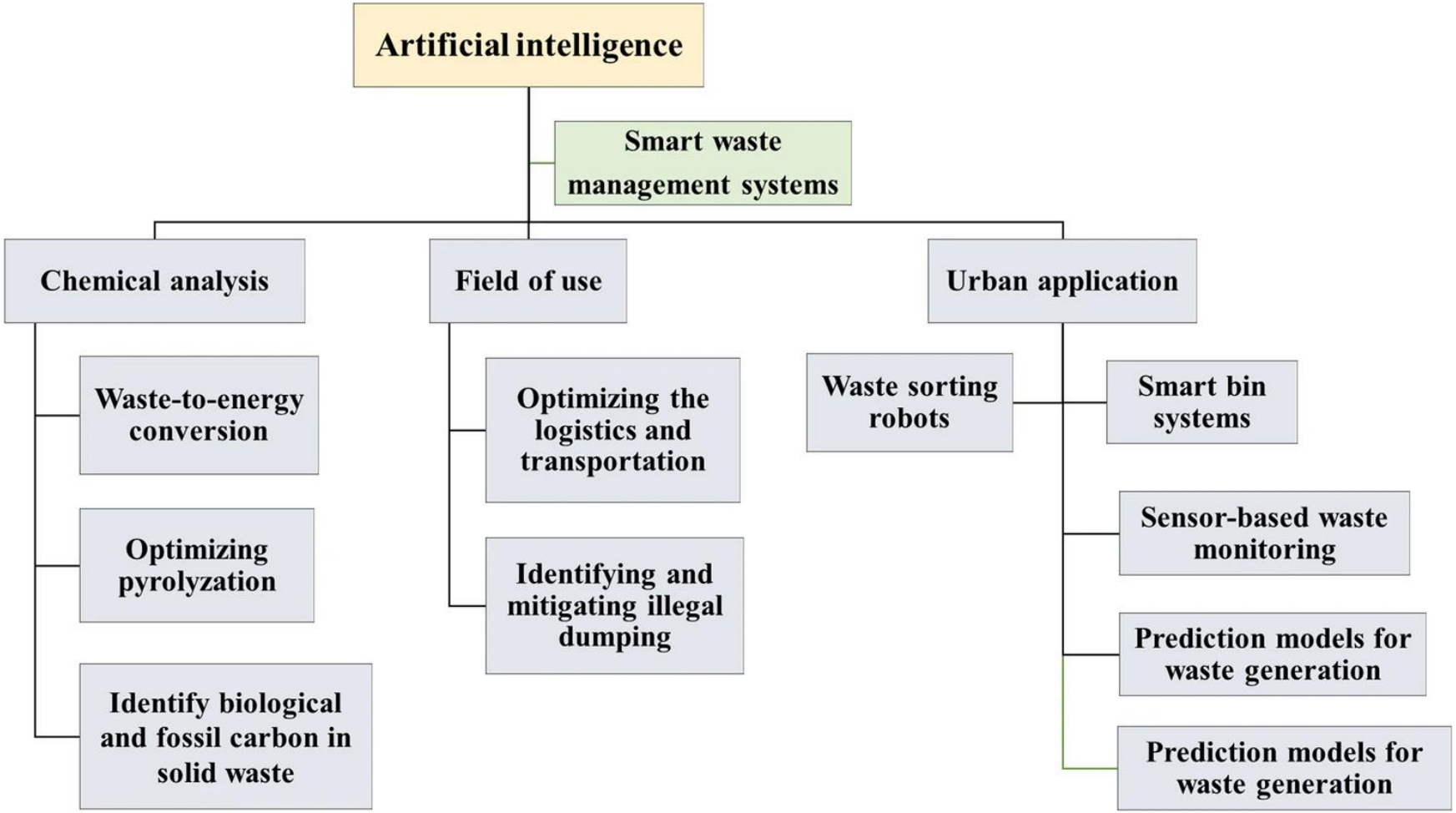
Advance technologies

- Building information modelling,
- Geographic information system,
- Big data,
- Radio frequency identification,
- Image recognition technology,
- Image analysis,
- Global positioning system
- Barcode technology.
- Recycling Robots



Source: https://www.mdpi.com/2071-1050/13/15/8427

Artificial Intelligence

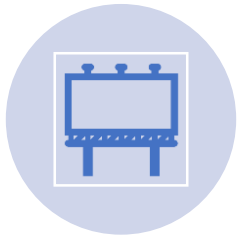


Source :https://link.springer.com/article/10.1007/s10311-023-01604-3

Public awareness strategies to implement policies

RIPPLE EFFECT, SPREADING MESSAGES PERSON TO PERSON. IMPLEMENTED VIA MARKETING AND CAMPAIGNS.

USING TECHNOLOGY, MODERN DAY NEW AND STORIES BEING SHARED FROM DENSE URBAN AREAS TO RURAL DEPTHS DUE TO EASY ACCESS TO SMART PHONES AND INTERNET IN INDIA.



CELEBRITY INFLUENCE, FACE OF THE CAMPAIGNS AND MARKETING.

IMPLEMENTATION THROUGH EDUCATION, AMENDING SYLLABI OF MULTIPLE SCHOOL AND UNIVERSITY BOARDS TO INCLUDE SUCH TOPICS.

TRADITIONAL MEDIA AND CULTURE ARE OLD SCHOOL MEDIUM OF SPREADING INFORMATION.

Sustainable waste management

- Using sustainable measures to utilize resources for present and future generations, and a practice to normalize with due course of time.
- Effectively managing waste and resources to develop cities for our future generations to thrive.
- A commitment for healthy living, against the (above-mentioned) concerns,
- Multiple global initiatives with goals which are globalized and goals which are regional based to make major governments normalize sustainable practices.

https://ars.els-cdn.com/content/image/1-s2.0-S2352554122000018-ga1_lrg.jpg

Conclusion

- India's journey in managing C&D waste is an evolving narrative of challenges met with innovation, collaboration, and determination. As the country marches forward, the best practices it adopts will serve as a beacon for others to follow

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WASTE TO WEALTH

Swachh Bharat Unnat Bharat

THANK YOU